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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/931,324	08/16/2001	Michael S. Barnes	AMAT/4184/ETCH/CHAMBER/JB	3945

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APPLIED MATERIALS, INC.
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EXAMINER

TRAN, BINH X

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 12/05/2002

4

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/931,324

Applicant(s)

BARNES ET AL.

Examiner

Binh X Tran

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 September 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-33 is/are pending in the application.
- 4a) Of the above claim(s) 25-33 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8, 10-18 and 20-24 is/are rejected.
- 7) ☐ Claim(s) 9 and 19 is/are objected to.
- 8) ☒ Claim(s) 1-33 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other.

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-24, drawn to apparatus, classified in class 156, subclass 345.
 - II. Claims 25-33, drawn to process, classified in class 438, subclass 706.
2. The inventions are distinct, each from the other because of the following reasons:

Inventions II and I are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus as claimed can be used to practice another and materially different process such as cleaning the chamber itself.
3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.
4. During a telephone conversation with Alex Nolte on 11-27-2002 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-24. Affirmation of this election must be made by applicant in replying to this Office action. Claims 25-33 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1, 13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In line 9-10 of claim 1 "variable impedance elements connected to the first and/or second electrode between the substrate support and an electrical ground" (emphasis added) is indefinite because it is unclear whether the impedance elements is connected to the first electrode between the substrate support and an electrical ground or not. The impedance elements cannot connect to the first electrode between the substrate support and electrical ground because the first electrode is not a substrate support. For the purpose of the examination, the examiner will assume the impedance element is connected to the ^{second} ~~first~~ electrode and an electrical ground.

In claim 13, "a variable impedance element" (emphasis added) is vague and indefinite and contradicted with claim 11. Claim 13 depends on claim 11. In claim 11, the applicants claim "the variable impedance elements" (i.e., plurality of impedance

elements). However in claim 13, applicants indicate that the variable element is singular not plural. For the purpose of examination, the examiner will assume that the variable impedance elements comprise two different variable impedance elements and each variable impedance element is connected to each electrode respectively.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 1, 3-8, 10-18, 20-21, 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmi (US 5,272,417) in view of Ohmoto et al. (US 6,413,876).

Respect to claim 1 and 14, Ohmi discloses an apparatus comprising:

a chamber (105) having a first electrode (107) disposed therein;

a substrate support (104) disposed in the chamber and providing a second electrode (i.e. susceptor electrode);

a high frequency (f1) source electrically connected to the first electrode (107);

a low frequency power source electrically connected to the second electrode (104) (See Fig 1A);

a impedance element (102b) connect to the first electrode (107) and the ground (Fig 1B, col. 7 lines 34-60);

Ohmi does not disclose the impedance element is a variable impedance element.

Ohmoto disclose variables impedance element connect to the substrate support

electrode to reduce damage on the wafer surface (col. 6 lines 29-67). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ohmi in view of Ohmoto by using a variable impedance element because it will reduce the damage occurs on the wafer surface.

Respect to claim 3 and 23, Ohmi discloses the first electrode (107) and the second electrode (104) form a parallel plate electrode (Fig 1A). Respect to claim 4 and 24, Ohmi discloses the chamber is configured as an etch chamber. Respect to claim 5 and 15, Ohmi discloses the high frequency power source is adapted to delivered power between 100 MHz-250 MHz (col. 11 lines 49-54, read on the range of "between about 13.56 MHz and about 500 MHz). Respect to claim 6, Ohmi disclose the low frequency of 10-50 MHz (col. 6 lines 65-68, read on the range of 100 KHz to 20 MHz).

Respect to claims 7-8, 17-18 Ohmi disclose the impedance element comprise a inductor (L1 and/or L2 and/or L3) and a capacitor (C_s , C_{s2} , C_{s3}) (See Fig 4B, or 1B). Ohmi fails to disclose a variable impedance elements comprise at least one variable capacitor. The use of variable impedance elements has been discussed in previous paragraphs. Ohmoto disclose that the variable impedance elements comprise an inductor (14) and a variable capacitor (13) (Fig 3, col. 6-15). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ohmi in view of Ohmoto by using a variable impedance element comprise a inductor and a variable capacitor because it will reduce the damage occurs on the wafer surface.

Respect to claims 10 and 20, Ohmi discloses the impedance elements (102, 402, 403) are adapted to tune at to the high frequency (f_1) (See Fig 1B) or low frequency (Fig

4B). The use of variable impedance elements has been discussed in previous paragraphs. Further Ohtoto also discloses that the variable impedance elements are adapted to tune to at least one frequency from the RF frequency (17) (Fig 3).

Claim 16 differs from the cited prior arts by the specific value of frequency. However, Ohmi discloses that the value frequency can be adjusted because it is a result effective variable. Result effective variables are commonly determined by routine experiment. The process of conducting routine optimization experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal frequency ranges as an expected result.

Respect to claims 11 and 21, Ohmi discloses the impedance elements (402 and 403) are adapted to tune to first resonant impedance at the low frequency (Fig 4B) and impedance element (102') tune to second resonant impedance at a high frequency (Fig 4B, col. 7 lines 18-25 and col. 12 lines 44-53). Respect claim 12, Ohmi discloses a high frequency ($f_2 = 100$ MHz) and the low frequency ($f_3 = 40$ MHz) are delivered to the electrode (104) and the impedance element (102') is connected to the electrode (107) (Fig 4B, col. 12 lines 36-68). Respect to claim 13, Ohmi disclose a high frequency (f_1) and the low frequency (f_3) are delivered to opposite electrode and a first impedance element (102) is connected to the electrode (107) and the second impedance element (402) is connected to the electrode (104).

10. Claims 2 and 22 rejected under 35 U.S.C. 103(a) as being unpatentable over Ohmi in view of Ohmoto and further in view of Wu et al. (US 5,585,012).

Ohmi discloses a means for introducing a gas into the chamber (i.e. a gas distributor). However, Ohmi fails to disclose that the first electrode comprise a gas distributor. In an etching apparatus, Wu teaches the first electrode (14) comprise a opening for distribute gas into the chamber (col. 5 lines 9-12). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Ohmi and Ohmoto in view of Wu by having the first electrode comprise a gas distributor because it help to excite the gas into plasma phase as the gas pass through the first electrode.

Allowable Subject Matter

11. Claim 9 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action.

12. Claim 19 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

13. The following is a statement of reasons for the indication of allowable subject matter: The cited prior arts fail to disclose or suggest that the variable impedance element(s) is/are adapted to tune a self bias voltage division between the first electrode and the second electrode (or substrate support).

Conclusion

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X Tran whose telephone number is (703) 308-

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1867. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Binh X. Tran
November 29, 2002

[Handwritten signature]
Binh X. Tran
November 29, 2002